Prevalence of tuberculin skin test reactivity among health care workers at a teaching hospital in Trinidad

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The prevalence of tuberculosis is increasing worldwide. The World Health Organization estimated that 8 million new cases and 3 million deaths annually are directly attributable worldwide to the disease each year, comprising 6% of all deaths [1]. Bloom and Murray [2] have identified categories of persons that are at special risk within the general population, as well as in the hospital setting [3,4]. Published data documenting the current risk to health care workers (HCW) within the Caribbean region is scanty. In fact, lack of reliable data on yearly skin testing of hospital employees have been shown to hamper the evaluation of tuberculosis outbreaks in some centres [3,5]. In the USA in 1993, health care workers accounted for 3.2% of total cases of tuberculosis reported to the Centers for Disease Control and Prevention [6]. Subsequent to this report, the CDC issued guidelines designed to prevent spread of tuberculosis in health care facilities [7]. Persons latently infected with *Mycobacterium tuberculosis* may be identified by skin testing with purified protein derivatives (PPD) of the organism (e.g. Mantoux test) and it is a reliable method for monitoring the exposure of HCW to infected persons, and the best means for determining the efficacy of infection control efforts.

There was no employee tuberculosis surveillance screening programme at the Eric Williams Medical Sciences Complex (EWMSC) prior to this study. This study was therefore conducted to define the prevalence of tuberculin reactivity among health care providers at the EWMSC before the transfer of patients and services from the National Chest Hospital at Caura and to provide ongoing monitoring with the development of specific infection control procedures.

The study was conducted from October 1, 1996 to January 31, 1997 and came about because the Ministry of Health was contemplating transferring patients with tuberculosis and those suspected of being infected with the organism, from the National Chest Hospital (Caura Hospital) to the Eric Williams Medical Sciences Complex (EWMSC), in April 1997. The EWMSC is a 560-bed medical facility located in the northwestern part of Trinidad, and is one of four major government-sponsored hospitals in Trinidad and Tobago. Trinidad is the larger of the twin island republic (Trinidad and Tobago) with a population of about 1.25 million and located 11 km off the northern coast of Venezuela in South America.

The Infection Control Committee of the EWMSC was concerned about the status of the staff at the Complex and requested that all health care providers be skin tested for tuberculosis. All staff members in contact with patients were asked to report to the newly established chest clinic which, along with the Infection Control Nurse, would assist in the skin testing program. Data collected included age, gender, prior Mantoux test results (measurement in mm) and history of previously diagnosed tuberculosis or BCG vaccination. No attempt was made to verify self-reported information by participants because no standardized employee health information existed during the study period. Staff members who gave a history of previously non-reactive Mantoux test (with or without a history of BCG) were skin tested by the same method (Mantoux). A solution of 0.1 mL (5 TU) PPD (Tubersol; Connaught, Willowdale, ON, Canada) was injected intradermally on the volar aspect of the forearm and read at 72 h by one of two trained public health nurses from the chest clinic. A positive Mantoux test was defined as a reading $\geqslant 10$ mm induration.

Participants with positive readings were offered free chest radiographs and asked to submit three early morning sputum specimens for culture. In most cases sputum samples were received before chest radiographs were done and reported on. Culture results were not available because shortly after the screening process started, the National Public Health Laboratory which processes sputa for tuberculosis began to experience internal structural problems that hampered laboratory performance. Recommendations for prophylaxis and treatment were offered according to guidelines from the World Health Organization [1]. Data were analysed using Epi Info Software version 6. Categorical variables were compared using chi-squared or Fisher's exact test. A P-value of <0.05 was considered significant, and all tests were two-tailed. Multivarate analyses were performed by logistic regression.

From the 445 HCW at the EWMSC only 182 (40.9%) responded to the request of the Infection Control Committee for tuberculin (PPD) testing. Of these 182, 81 (44.5%) were

PPD-positive. The PPD-positive rates were greatest (55%) among the group aged at least 40 years, whereas the 25–29-year-old age group had the lowest PPD-positive rates (19%). The mean age for PPD-positive persons was slightly greater (44 years) than that for PPD-negative persons (38 years) (Table 1). Among females, 46% were PPD positive versus a 38% positivity rate for men. This was not statistically significant ($\chi^2 = 1.10$; P = NS). One hundred and seventy-five participants had no history of BCG vaccination. Of these, 78 (44.6%) were PPD-positive compared with three of seven (43%) with a positive history of BCG vaccination.

Nurses comprised almost 60% of all PPD-positive persons and were the greatest number screened (Table 2). None of the PPD-positive staff members showed radiographic evidence of pulmonary disease. Of the 82 doctors among the staff, only six (7.3%) participated and only 7.1% of the 14 dentists was involved in the screening process. The other category of PPD-positive staff were dental nurses (two of 21), nursing assistants (seven of 12), radiographers (two of six), patient escort (seven of 17), physiotherapists (one of two) and central supplies processing department personnel (seven of 17) (Table 2).

Multivarate regression analysis of PPD status, controlling for age and gender demonstrated that increasing age and gender were independently associated with a positive PPD skin test in the study.

The prevalence of tuberculin reactivity in our survey was 45%. This closely agreed with observations made by Sepkowitz et al. (New York, USA) [8], and Stracher et al. (USA) [9], who

Table 1 Characteristics of purified protein derivatives (PPD) test-positive and PPD test-negative health care providers at the Eric Williams Medical Sciences Complex in 1997

Characteristics	Total	PPD-positive	PPD-negative	Significance χ^2; *P*-value
Number screened	182	81	101	
Age group (years):				
<25	8	2 (25.0%)	6	12.23; <0.001
25–29	21	4 (19.0%)	17	
30–34	29	12 (41.4%)	17	
35–39	22	9 (40.9%)	13	
$\geqslant 40$	97	53 (54.6%)	44	
Age unknown	5	1 (20.0%)	4	
Gender:				
Male	40	15 (37.5%)	25	1.10; NS
Female	142	66 (46.5%)	76	
BCG* vaccination history				
Yes	7	3 (42.9%)	4	
No	175	78 (44.6%)	97	

* BCG, Bacillus of Calmette–Guerin.
Mean age for PPD-positivity and negativity rates were 44 and 38 years, respectively. Age range (years) was 24–68 and 20–60 years for PPD-positive and PPD-negative participants, respectively.

Table 2 Distribution of purified protein derivatives (PPD) test results for 182 health care providers according to job category

Job category	Total staff strength	No. (%) of participating staff	No. (%) of PPD-positive staff*
Registered nurse	170	99 (54.4)	48 (59.3)
Dental nurse	39	21 (11.5)	2 (2.5)
Physician	82	6 (3.3)	4 (5.0)
Dentist	14	1 (0.6)	1 (1.2)
Nursing assistant	35	12 (6.6)	7 (8.6)
Radiographer	16	6 (3.3)	2 (2.5)
Physiotherapist	11	2 (1.1)	1 (1.2)
Anaesthetic technician	5	1 (1.1)	1 (1.2)
Patient escort	53	17 (9.3)	7 (8.6)
CSPD technician[a]	20	17 (9.3)	8 (8.6)
Total	445	182	81

* Based on participating workers.
[a] CSPD, central supplies processing department.

reported a positivity rate of 40% and 36%, respectively, but it is considerable higher than rates described in past surveys. Fraser et al. [10], found that 25% of physicians at Barnes Hospital in St. Louis were infected with *Mycobacterium tuberculosis*, and other reports from Cross and Hyams [11], The Center for Disease Control and Prevention [12] and Bowden and McDiamid [13], reported rates of 0.97, 4–5, and 25–48%, respectively. Our comparison to these rates may seem inappropriate as the populations involved in these studies differed in a number of ways from our study population. There are only scant references to tuberculin positivity in HCW during workshops and seminars in Trinidad, and no documentation for HCW in any other Caribbean country with a similar economic and geographical profile. In these studies however, higher rates of PPD-positivity rates were associated with a past history of BCG vaccination and the length of time participants were employed. But the high prevalence rate that were observed in this study could not be due to prior BCG vaccination alone, because 44.6% (78 of 175) of HCW with a positive PPD skin test, had no history of BCG vaccination. BCG vaccination was discontinued in 1976 because of low prevalence rates, <5 per 100 000 population (records of National Chest Hospital, Caura). In view of the ongoing AIDS epidemic with an apparent increase in tuberculosis cases (135 per 100 000, in 1996 to 210 per 100 000 population in 1997 (up to June) [14], the decision has been taken by the authorities to re-introduce BCG vaccination at birth and in school children. At present no decision has been taken to offer BCG vaccination to HCW.

The 45% of our HCW with tuberculin skin conversion may be reflecting a relatively high base line rate of community-acquired *Mycobacterium tuberculosis* infection as suspected cases of tuberculosis are admitted directly to the National Chest Hospital, not to the EWMSC. This may also have serious implications for nosocomial infections and infection control policies for the institution. In Trinidad and Tobago in the 1940s, the prevalence of tuberculosis was 100 per 100 000 population, whereas in the 1970s the rate was <5 per 100 000 population. However, in the 1980s the rate was double (~ 10 per 100 000) that of the 1970s, and in 1996 and 1997 (up to June), the rates were 35 per 100 000 population and 210 per 100 000 population, respectively. These incidence rates parallel the increase in AIDS cases. Between 1993 to the first quarter of 1997, the rates per 100 000 population were 20.5, 22.6, 27.0 and 9.3 (1st quarter 1997) [15], respectively. These figures reflect a cross-sectional survey of the population, but no specific data were made available for the HCW at the nation's health care facilities. Although HIV infection is associated with an increased prevalence of pulmonary tuberculosis cases [16], it is not known within this society how much the epidemiology of *Mycobacterium tuberculosis* infection, as opposed to disease, overlaps with the epidemiology of HIV infection. It is therefore difficult to predict the impact of the local HIV-infection/AIDS situation on the increase in prevalence of tuberculosis cases.

In conclusion, a high rate of tuberculin reactivity was detected among HCW at the EWMSC, prior to the transfer of patients and services from the National Chest Hospital at Caura. This high prevalence rate may reflect already high undetected rates of infection in the community as alluded to in the report by Beach et al. [14]. Reducing the risk of exposure will depend, not on screening via PPD testing *per se*, but on implementation of effective infection control procedures, for example: respiratory isolation for patients presenting with fever and cough; protection of immunocompromised (e.g. HIV-infected) patients from exposure to suspected or proven TB cases; chemoprophylaxis for individuals exposed to known cases of TB and BCG vaccination of HCW. Full evaluation of all suspected cases and therapy are essential. All PPD tuberculin skin-test positive HCW, were offered isoniazid prophylaxis, but compliance was difficult to assess and subsequent follow-up was not possible as most PPD positive participants in our study have left the employ of the EWMSC.

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Serotypes, biotypes and antimicrobial susceptibilities of *Haemophilus influenzae* isolated from invasive disease in children in Casablanca

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Haemophilus influenzae can cause a variety of invasive diseases in children. These infections are responsible for sequelae [1] and important mortality [2–4]. Resistance of *H. influenzae* to a variety of antimicrobial agents has been reported with increasing frequency in recent years [5,6], although in countries where vaccination against *H. influenzae* serotype b has been introduced, an important decline in the incidence of invasive disease has been noticed [7,8].

Recommendations for vaccination policies and antibiotic treatment must be guided by local epidemiology. Recent data on invasive infections of *H. influenzae* in Africa are very rare. The aim of this study was to determinate the serotype, biotype and the levels of antibiotic resistance of *H. influenzae* responsible for invasive disease at the Casablanca IbnRochd University hospital over a period of 2.5 years.

From June 1994 to December 1996, 117 strains of *H. influenzae* were isolated from children aged 0–15 years with invasive disease, who were admitted to the Ibn Rochd University Hospital of Casablanca. Among the 117 strains, 109 were serotyped, 112 were biotyped, 115 were tested for beta-lactamase production and 85 were tested for their susceptibilities to cefotaxime, chloramphenicol, erythromycin and rifampin. Serotyping was carried out by testing the supernatant of a broth culture in tryptic soy broth supplemented with Fields Enrichment (BBL) by countercurrent-immuno-electrophoresis with polyvalent and monovalent antisera (Difco Laboratories, Detroit, MI, USA). Biotype was determined by the study of ornithine decarboxylase and indole production and urea utilization with the API 10 s system (BioMerieux, Narcy L'etoile, France) or Rosco tablets and urea indole medium (Sanofi-Pasteur, Marnes La Coquette, France). Beta-lactamase production was detected with a nitrocefin-impregnated disc (Carr Scarborough Microbiologicals, Decatur, Georgia, USA). Quality control for betalactamase production was carried out with *Staphylococcus aureus* ATCC 29213. The minimum inhibitory concentrations were determined on Mueller–Hinton chocolate agar by the agar dilution method with an inoculum of 10^4 CFU per spot. The breakpoints used were those recommended by the National Committee for Clinical Laboratory Standards [9]. *H. influenzae* ATCC 49247 was used as quality control. Data entry and analysis were carried out using Epi Info 5 (WHO).

From the 117 isolates of *H. influenzae* responsible for invasive disease, 74.4% were recovered from cerebrospinal fluid. The other sites were blood (16.2%), articular fluid (6.8%) and respiratory tract specimens (2.6%). These infections were caused mainly by serotype b (99.1%). The nontypable isolates were rare in our series; only one case was isolated from articular fluid. The age of the patients was available for 113 children and 89.3% occurred in children that were less than 2 years of age (Figure 1). In our series, all biotypes could be responsible for invasive diseases in children, but at a different magnitudes: biotype I (57.1%), II (13.4%), VII (9.8%), VI (5.3%), VIII (5.4%), IV (3.6%), III (4.5%) and V (0.9%). Three isolates (2.6%) produced a beta-lactamase. These strains belonged to serotype b, and were responsible for meningitis. One of these strains was also resistant to chloramphenicol, although chloramphenicol was